

On August 3, 2015 the Environmental Protection Agency finalized the Clean Power Plan, to reduce CO<sub>2</sub> emissions from existing coal power plants by 30% below 2005 levels by 2030

# Contrasting futures for ocean and society from different anthropogenic CO<sub>2</sub> emissions scenarios



2°C/  
3.6°F  
Increase

Low CO<sub>2</sub> emissions  
(RCP2.6)

2100  
(Year)

Business-as-usual  
(RCP8.5)



+1.2°C ← ΔT → +3.2°C  
 -0.14 units ← ΔpH → -0.4 units  
 +0.60 m ← SLR → +0.86 m



Mitigate

Adapt

Protect

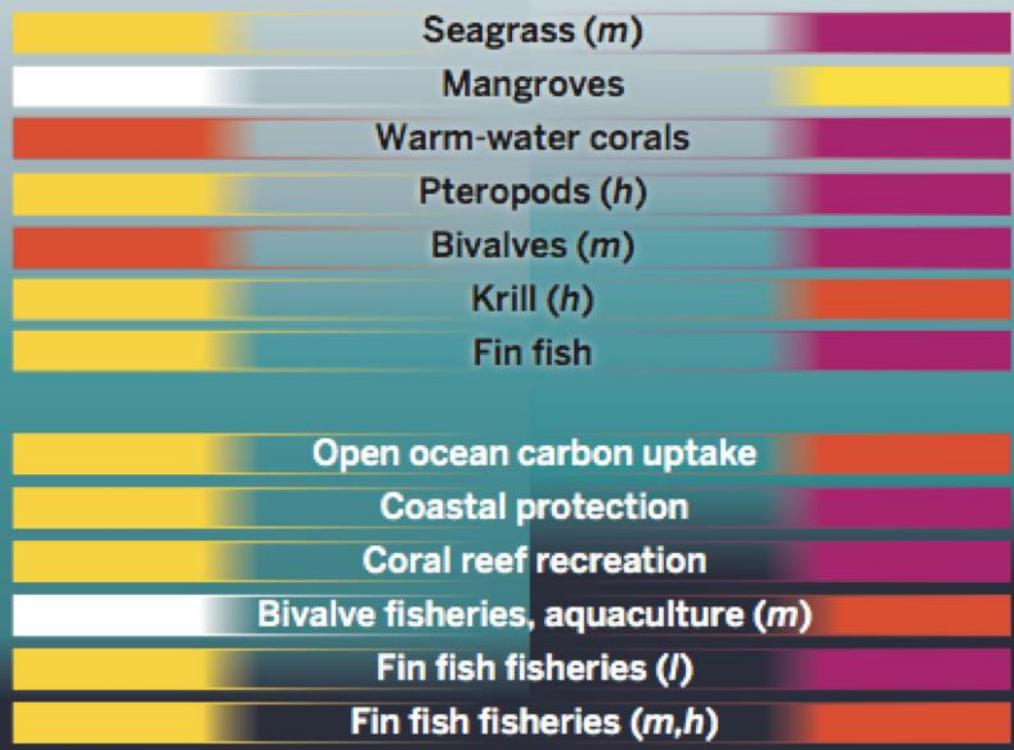
Repair

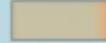
Mitigate

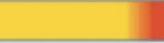
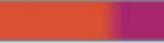
Adapt

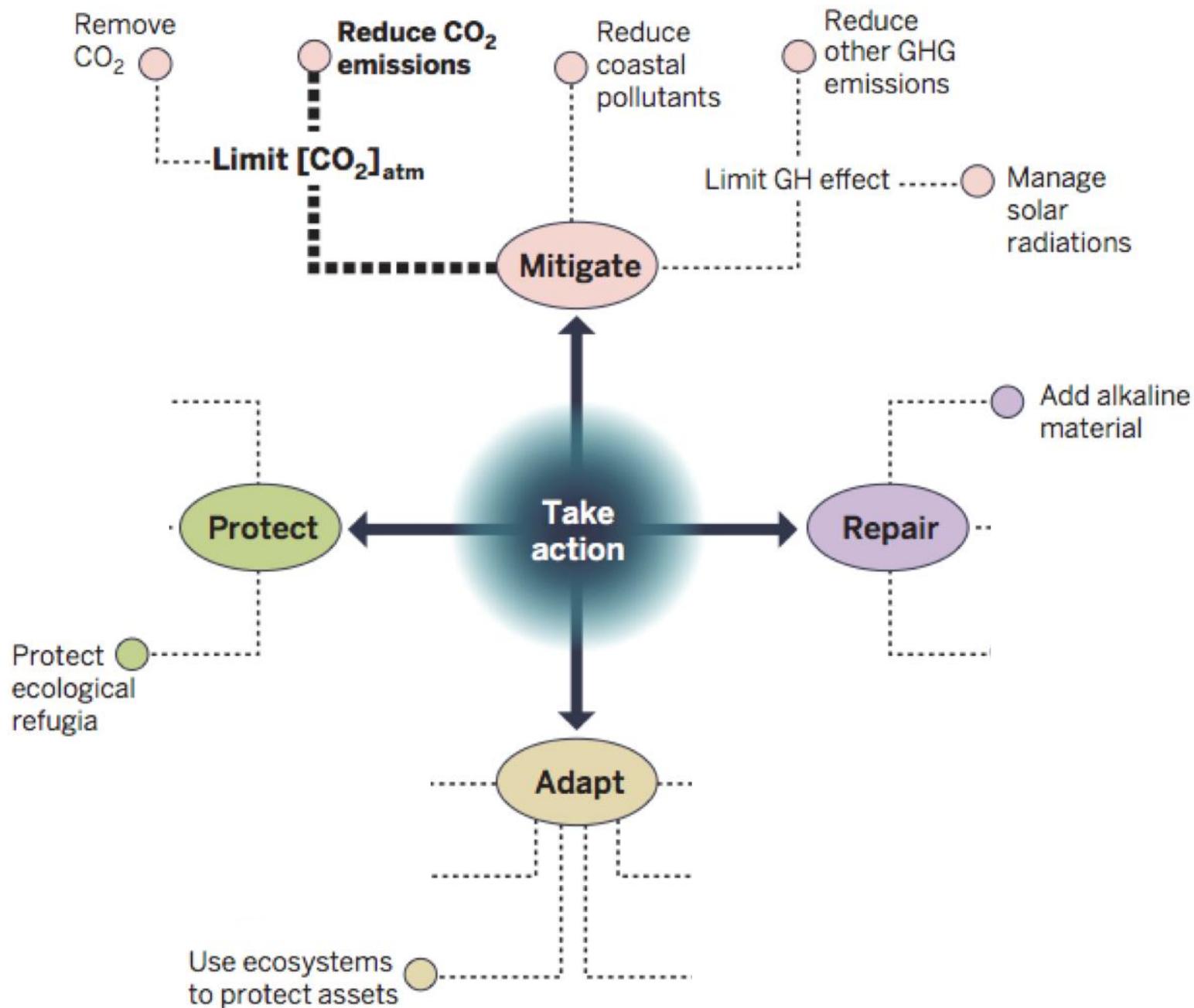
Protect

Repair



Management options  
 Less efficient   More efficient

Risk of impact  
 Undetectable  Moderate  High  Very high 



# Climate Change Threatens the Survival of Coral Reefs

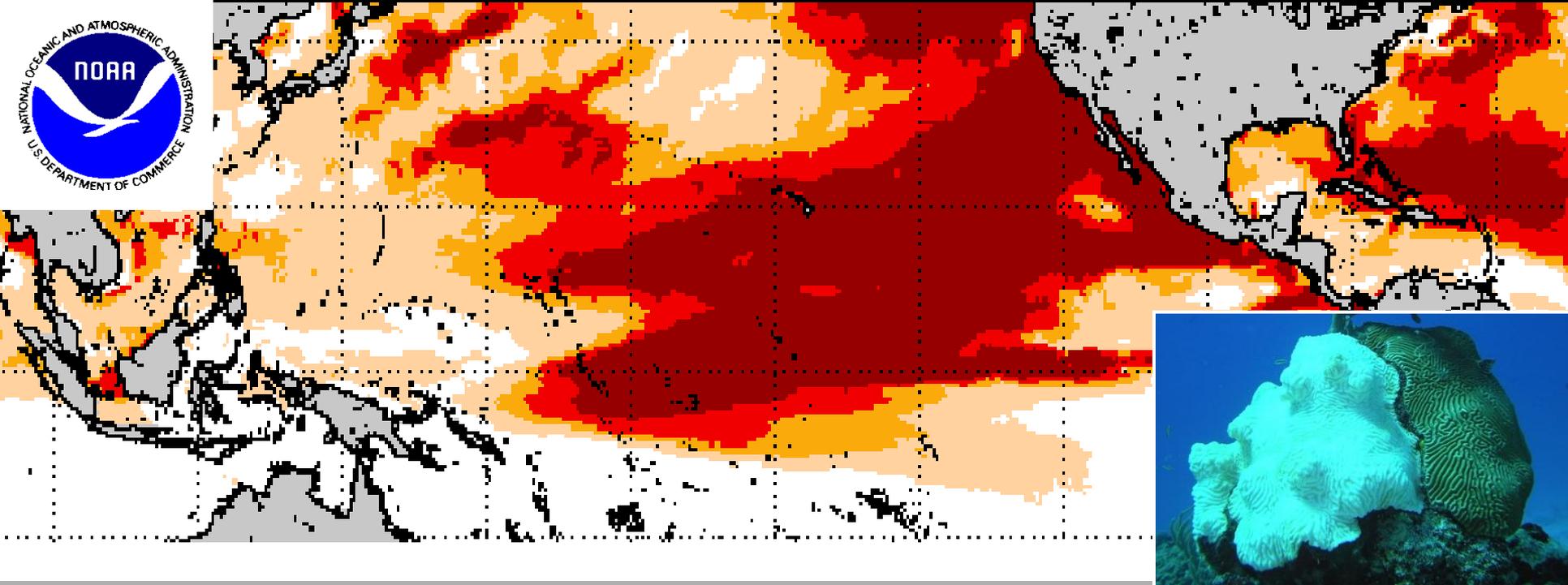


If average global surface temperatures increase by 2°C or more, relative to the pre-industrial period, the resultant ocean warming, along with acidification, will lead to continued widespread destruction of coral reef ecosystems over the next few decades.

The emission reduction pledges submitted to date by the international community fall well short of what is required needed to avoid this biodiversity catastrophe.

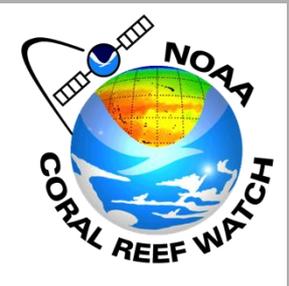


***ISRS Consensus Statement on Climate Change and Coral Bleaching, October 2015***



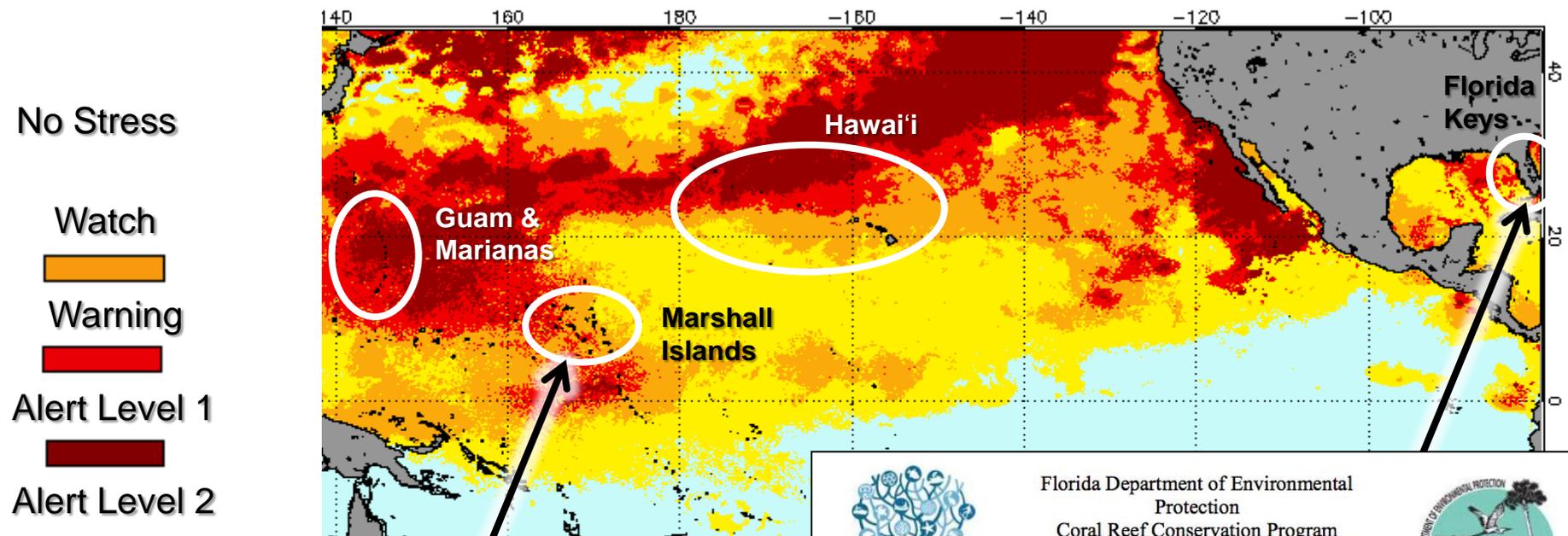
# 2014-16? Coral Bleaching Event

Dr. C. Mark Eakin  
NOAA Coral Reef Watch  
<http://coralreefwatch.noaa.gov>



# 2014 Severe Bleaching

## NOAA Coral Reef Watch Annual Maximum Satellite Coral Bleaching Alert Area 2014



No Stress

Watch

Warning

Alert Level 1

Alert Level 2





Florida Department of Environmental Protection  
Coral Reef Conservation Program  
**SEAFAN BleachWatch Program**  
Current Conditions Report #20140902  
September 2, 2014

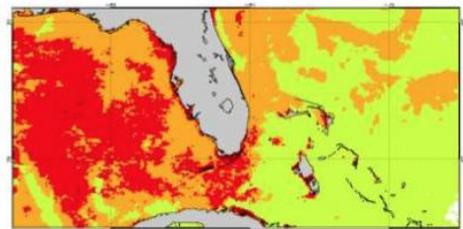


**Summary:** Based on climate predictions and field observations, the threat for mass coral bleaching in southeast Florida, between Miami-Dade and Martin counties is currently **HIGH**.

**Environmental Monitoring**

The latest CRW experimental 5 kilometer (km) Daily Coral Bleaching Alert Area (Figure 1) indicates that southeast Florida is presently experiencing a moderate to high level of thermal stress, with an Alert Level 1 or Bleaching Warning present throughout the region. This indicates that bleaching is likely in southeast Florida and additional alerts are possible if current conditions continue or worsen.

NOAA's Bleaching Hotspot Map compares current SST to the maximum monthly mean, which is the average temperature during the

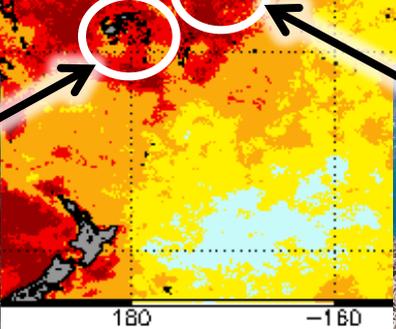
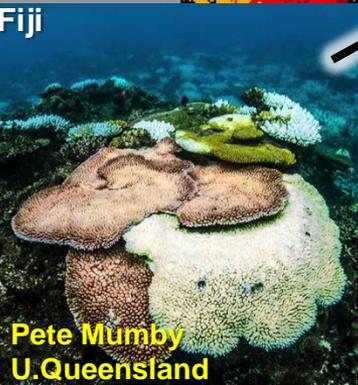
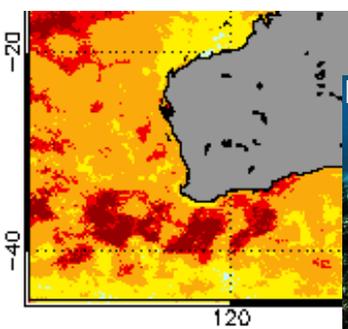
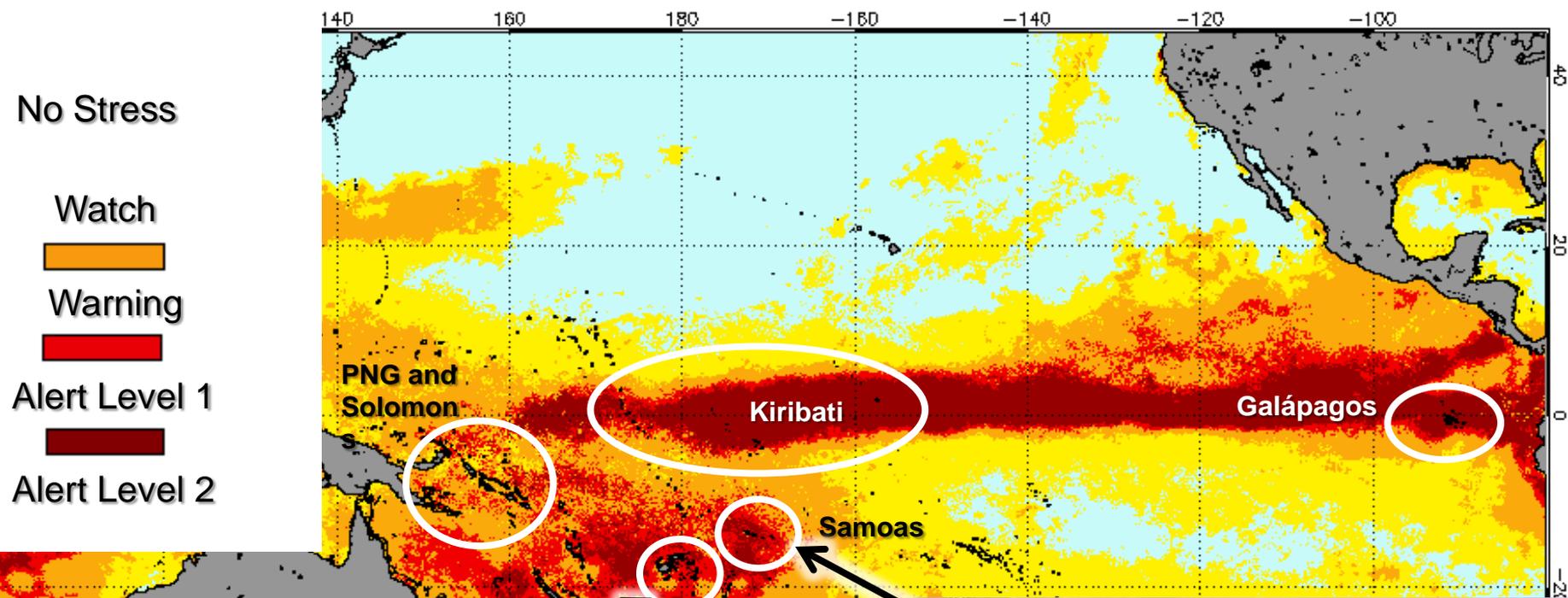


No Stress
Watch
Warning
Alert Level 1
Alert Level 2

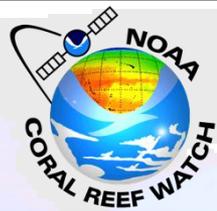
**Figure 1.** NOAA CRW Experimental Daily 5 km Blended Geo-Polar Nighttime Blended Bleaching Alert Area; August 31, 2014  
<http://coralreefwatch.noaa.gov/satellite/bleaching5km/index.php>

# Severe Bleaching Jan-June 2015

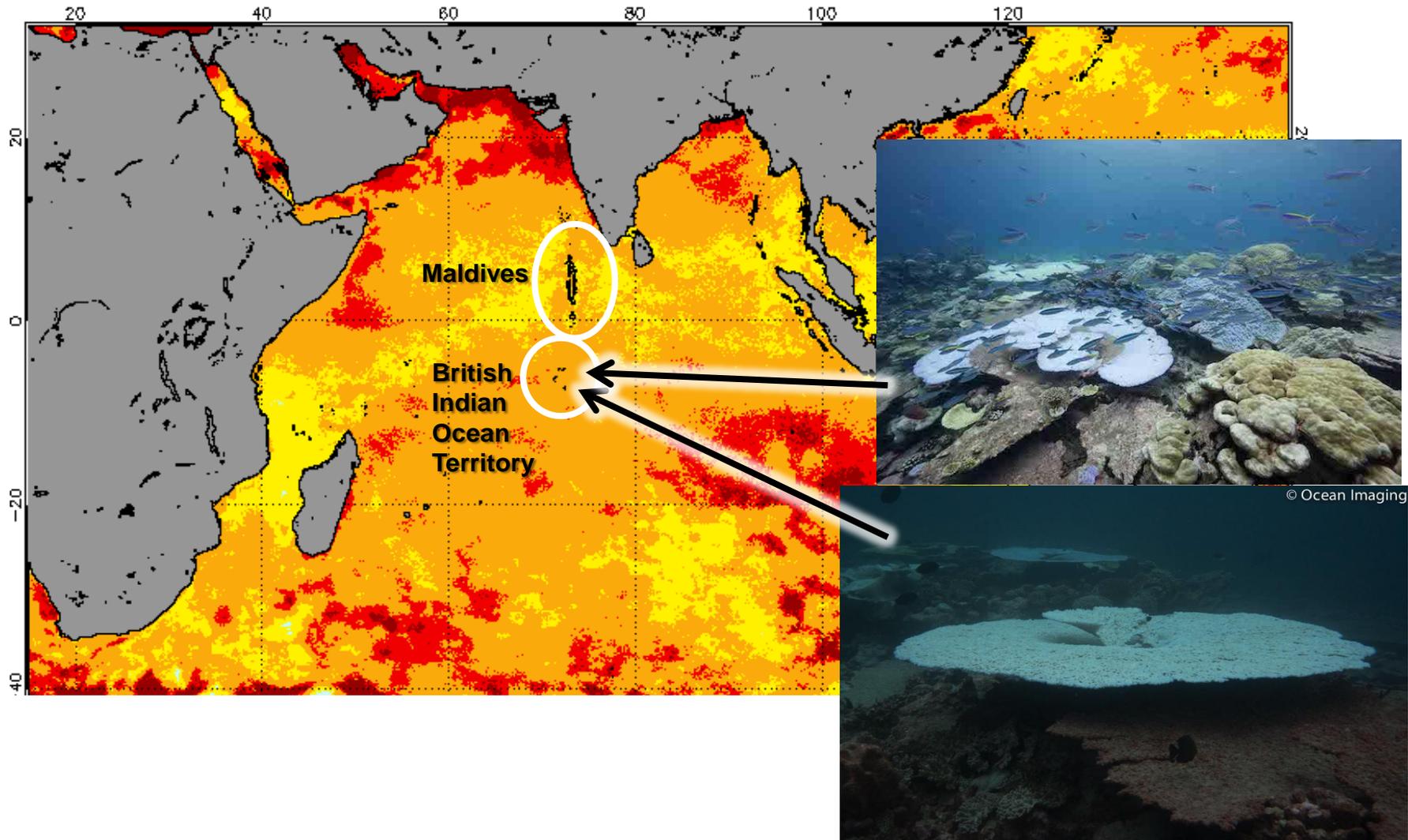
NOAA Coral Reef Watch Annual Maximum Satellite Coral Bleaching Alert Area 2015



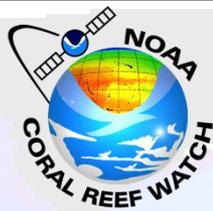
# 2015 Indian Ocean Bleaching



NOAA CRW 5-km Night-Only Bleaching Alert Area Year-to-date Maximum 26 Oct 2015



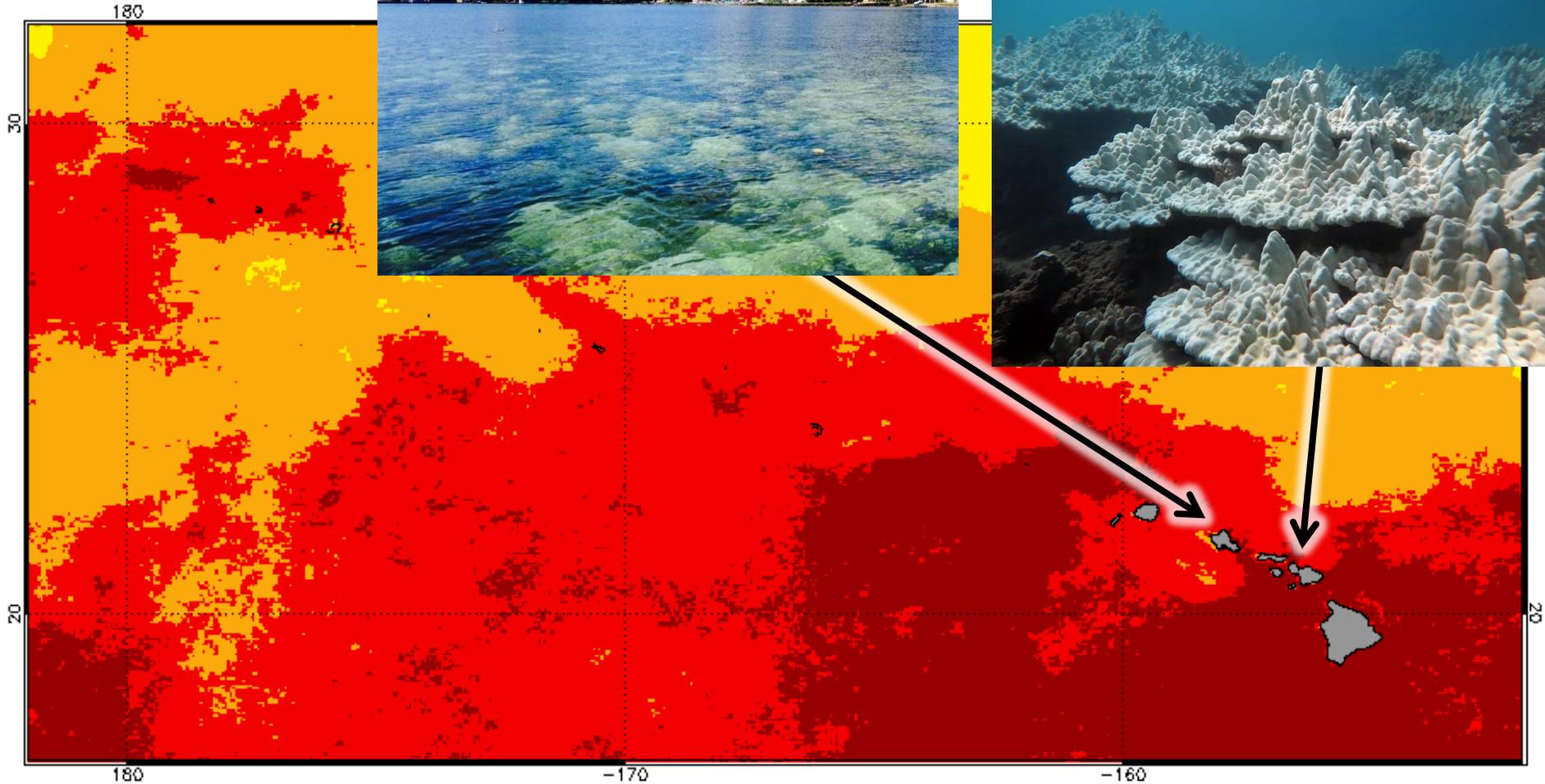
# 2015 Hawaii Bleaching



NOAA CRW 5-km Night



Maximum 26 Oct 2015



No Data

No Stress

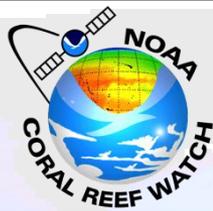
Watch

Warning

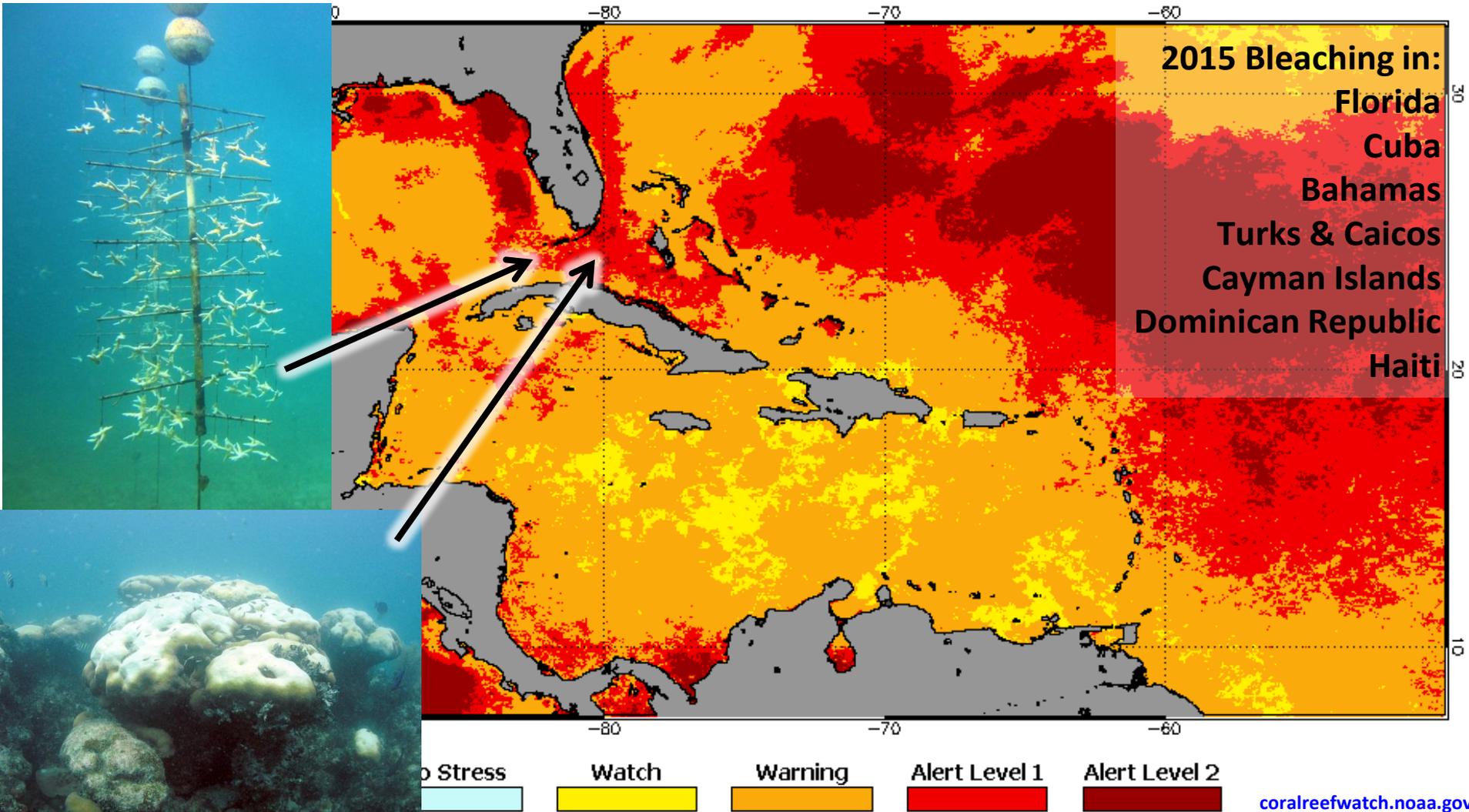
Alert Level 1

Alert Level 2

# 2015 Caribbean Bleaching



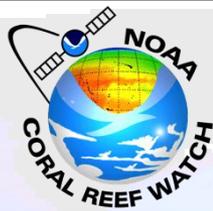
NOAA CRW 5-km Night-Only Bleaching Alert Area Year-to-date Maximum 26 Oct 2015



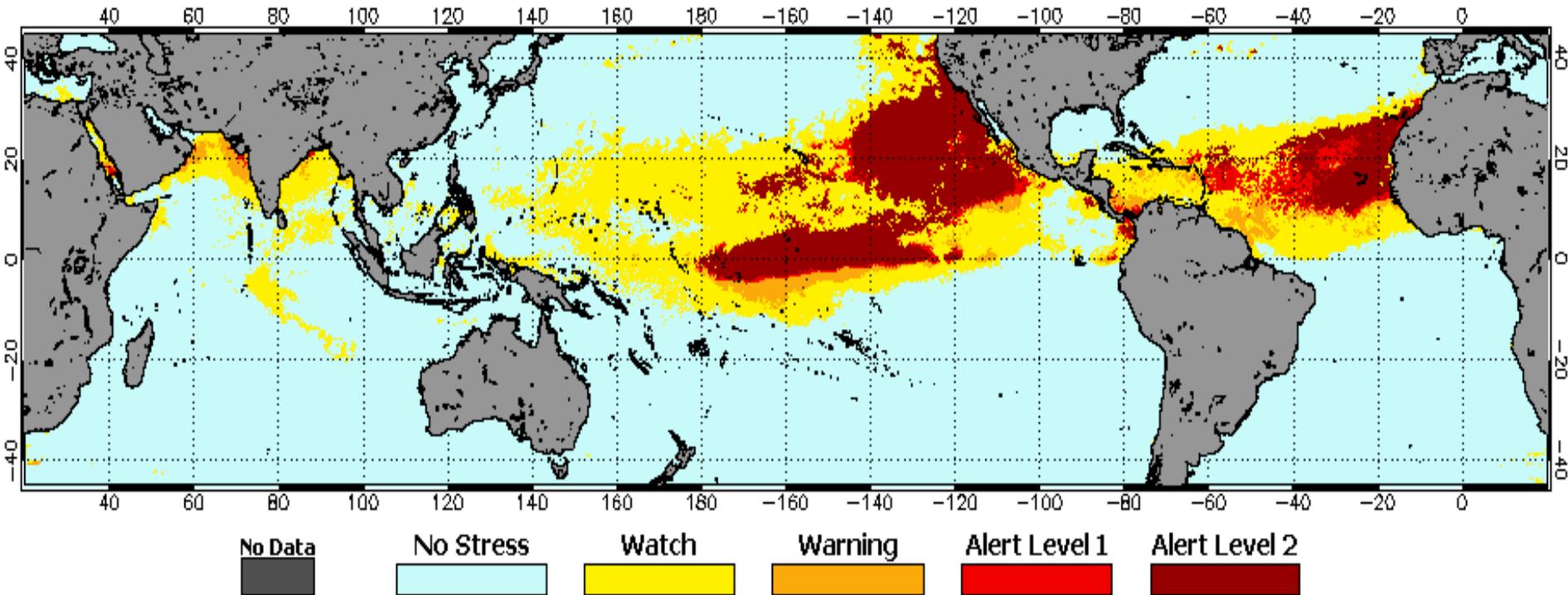
# Scientists say a dramatic worldwide coral bleaching event is now underway



# Which Reefs are at Risk for Bleaching Now?

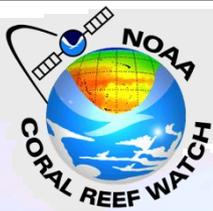


NOAA Coral Reef Watch Daily 5-km Geo-Polar Blended Night-Only Bleaching Alert Area 7d Max 26 Oct 2015



<http://coralreefwatch.noaa.gov>

# June 2014-December 2015 Thermal Stress



## Global Reefs:

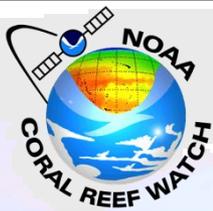
- 30% exposed to Alert Level 1 or 2
- 99% stressed

## US Reefs:

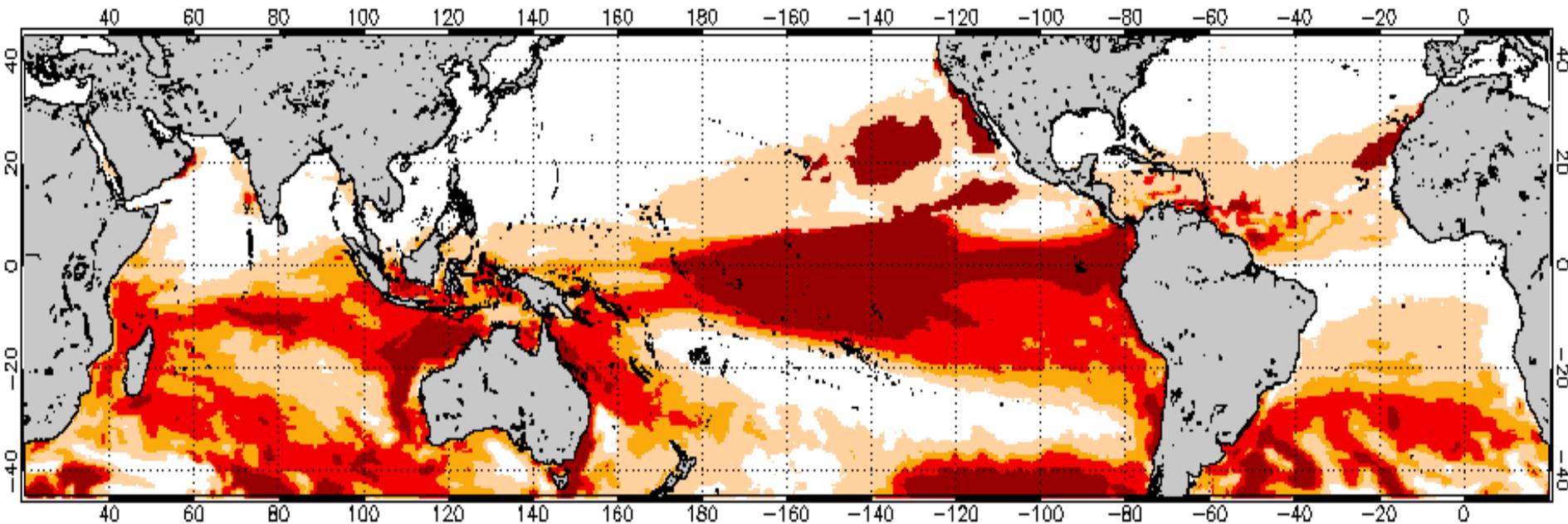
- 70% exposed to Alert Level 1 or 2
- 100% stressed



# Which Reefs are at Risk of Bleaching Soon?



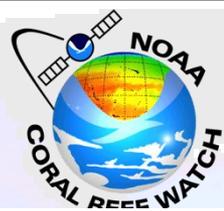
2015 Oct 27 NOAA Coral Reef Watch 60% Probability Coral Bleaching Thermal Stress for Nov–Feb 2016  
Experimental, v3.0, CFSv2–based, 28–member Ensemble Forecast



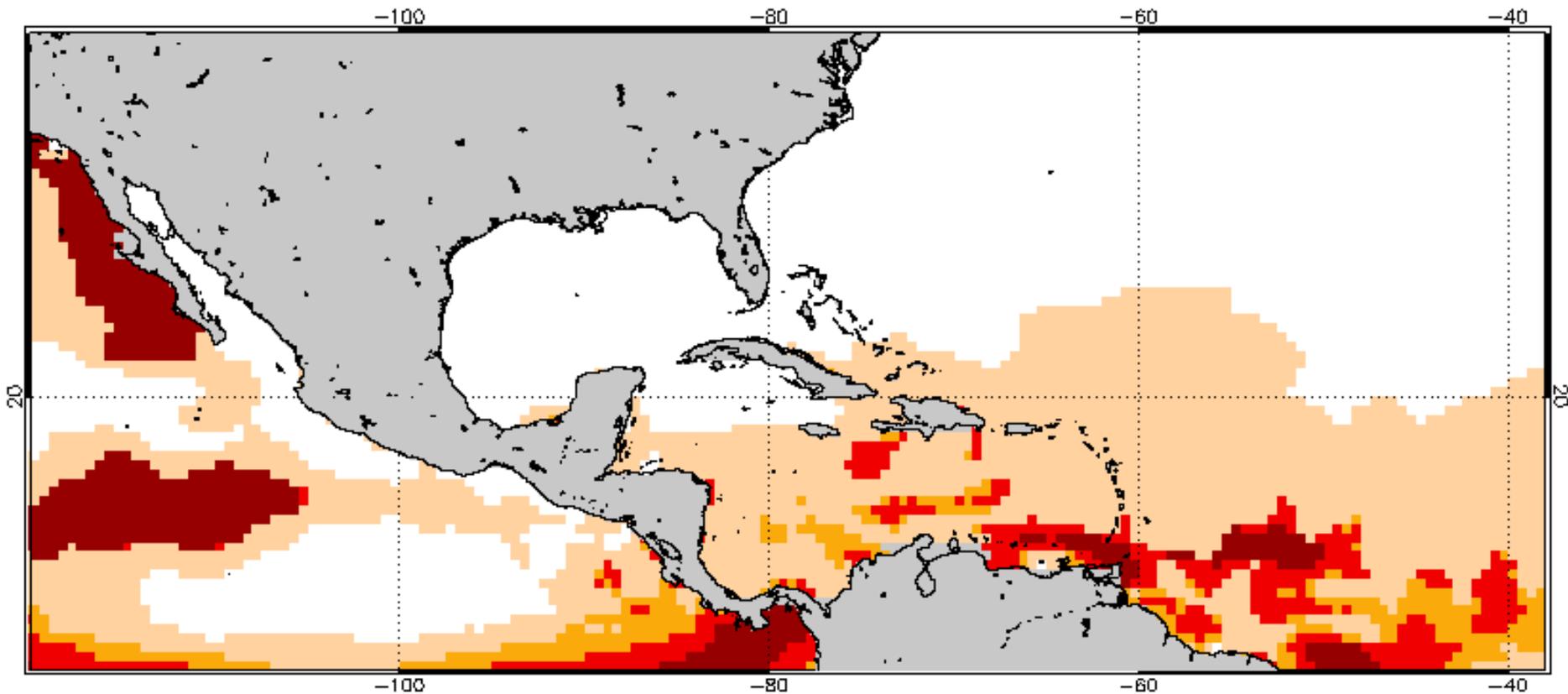
Potential Stress Level:  Watch  Warning  Alert Level 1  Alert Level 2



# Which Reefs are at Risk of Bleaching Soon?



2015 Oct 27 NOAA 60% Probability Coral Bleaching Thermal Stress for Nov–Feb 2016  
Experimental, v3.0, CFSv2–based, 28–member Ensemble Forecast



Potential Stress Level:

 Watch

 Warning

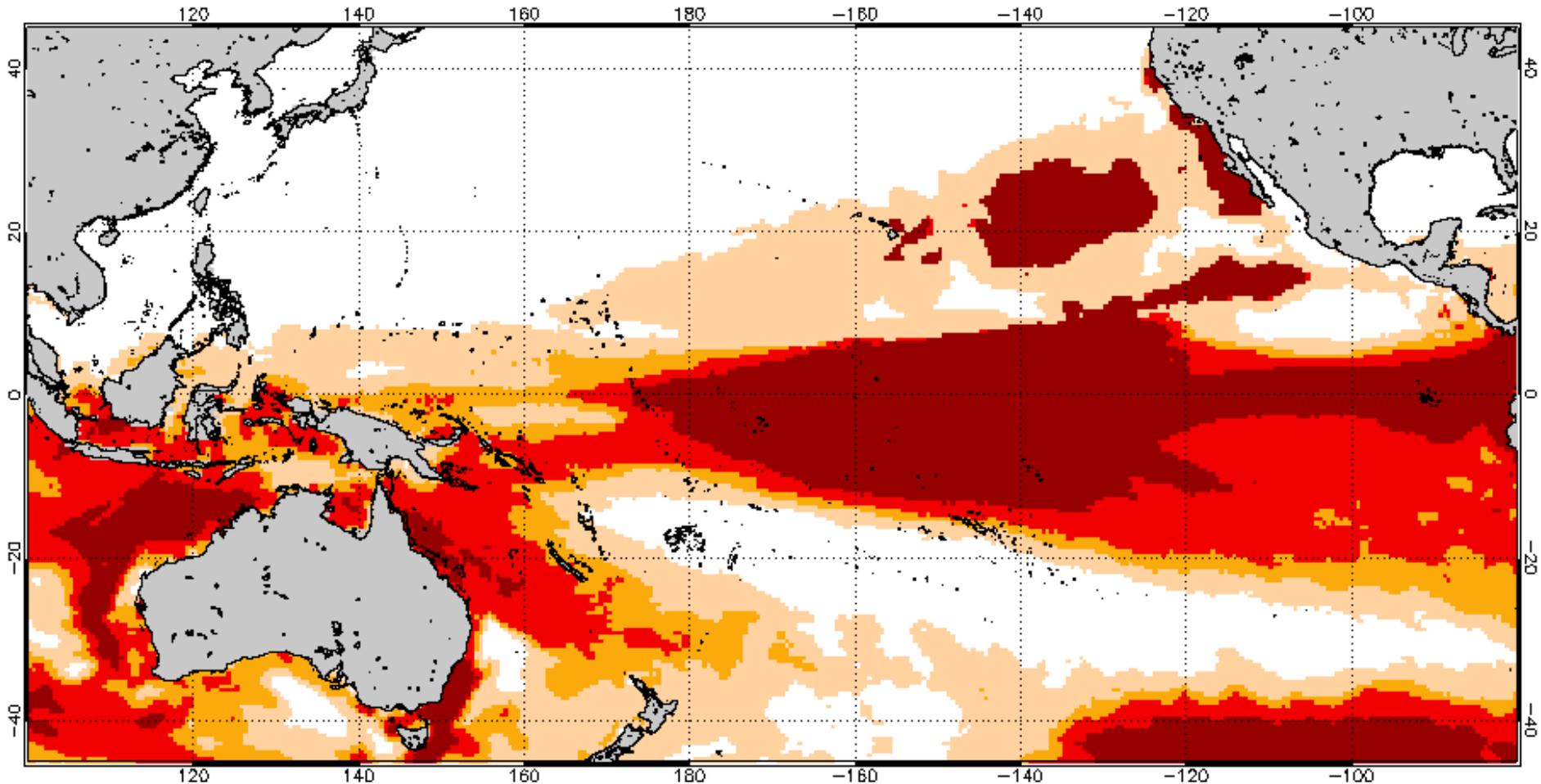
 Alert Level 1

 Alert Level 2

# Which Reefs are at Risk of Bleaching Soon?

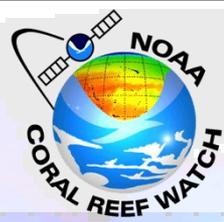


2015 Oct 27 NOAA Coral Reef Watch 60% Probability Coral Bleaching Thermal Stress for Nov–Feb 2016  
Experimental, v3.0, CFSv2-based, 28-member Ensemble Forecast

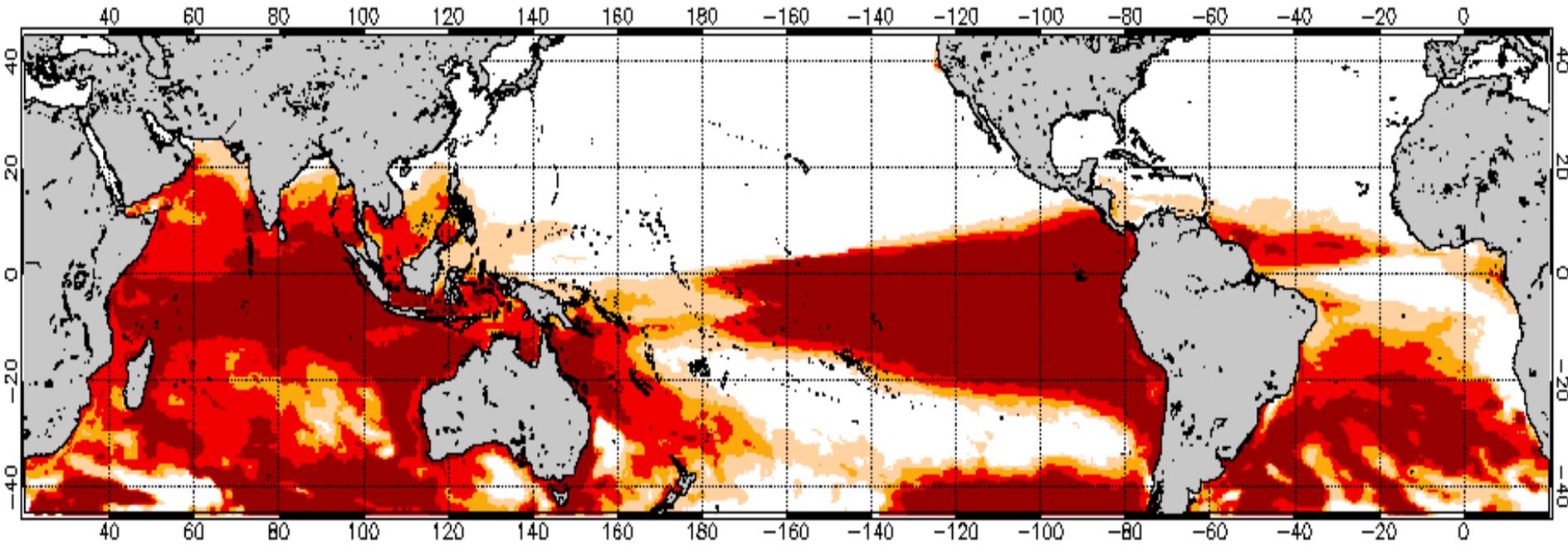


Potential Stress Level:  Watch  Warning  Alert Level 1  Alert Level 2

# Bleaching Expected to Continue through 2016 Likely to Return to Caribbean



2015 Oct 27 NOAA Coral Reef Watch 60% Probability Coral Bleaching Thermal Stress for Mar-May 2016



Potential Stress Level:  Watch  Warning  Alert Level 1  Alert Level 2